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SEEPAGE WETLAND AREA; A CASE STUDY ON HANUMANGARH DISTRICT

KAMAL KANT (DEPT.OF GEOGRAPHY) SMT.K.D.G.D.MITTAL MAHILA PG MAHAVIDHYALYA SARDARSAHAR (CHURU)

Hanumangarh the northern most district of Rajasthan with a total geographical area of 9656 Km² is located between 29.15° N 74.49° E'. Climate of these district is not arid. There minimum and maximum temperature 10°C and 50°C. Mean annual rainfall is 281mm with a coefficient of variation of 50 and probable maximum precipitation of 45 cm. These varies from 350 mm to 250 mm with a deceasing trend from south east to north east, rainy season of the district July to September.

The northern part of the Hanumangarh districts chiefly Ghaggar flood plain with thick layer of alluvium and blown sand. Southern parts of these districts are characterized by sand dunes and inter dune plains. The relative high of the sand dunes reach up to 50 meter Ghaggar river which is also known as "Nalli" is a ephemeral one and has north east south east course near Hanumangarh . Sometime Ghaggar get flooded during monsoon and cause expensive damage of crops and property. There the major soil groups are sandy to loamy sand at places underlined by lime can creation and gypsiferous substrate. This gypsiferous substrate is caused water logging problem which is called common dialect as 'SEM'.

There are mainly five types of water bodies present at Hanumangarh District.

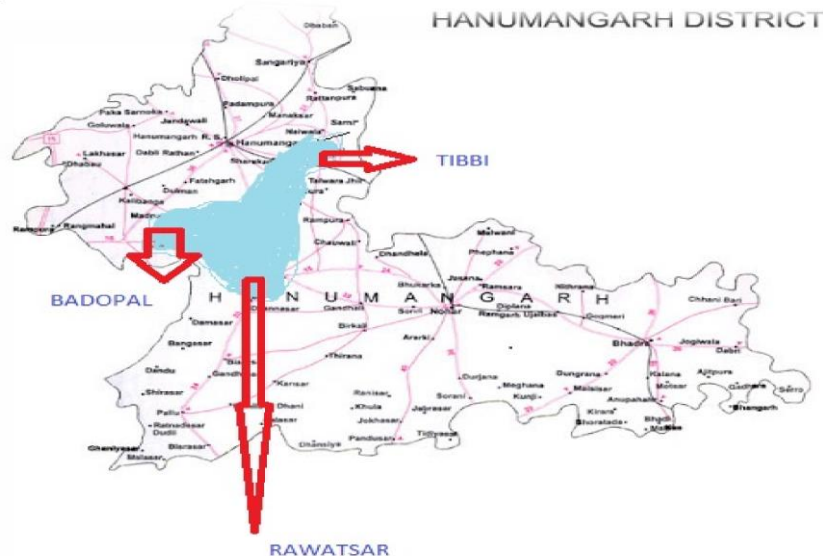
- 1) Village Ponds
- 2) Canal water source
- 3) Seepage wetlands ("Sem" water)
- 4) Water escapes
- 5) Drainage waste water.

➤ WHAT ARE SEEPAGE WETLANDS

Occurring naturally along stream banks or at the heads of streams, seepage wetlands are characterised by water- tolerant plants; saturated, organically-enriched, anaerobic soils; and standing water. They are generally disliked by farmers because of the risk of livestock and vehicles getting stuck and because they're unproductive. However, these areas are useful sinks for nitrogen (N), phosphorus (P), sediment and pathogens washed off paddocks.

In Hanumangarh, district have many area are seepage wetland. Seepage wetland are a serious problem of Hanumangarh (Rawatsar and Tibi, Badopal) . Seepage from canal converted fertile field in water logged and marshy land. 2.69% area of these districts has been found wasteland. This water logged area also affected by salinity or alkalinity problem. The extent of actual submerged area varies from season to season and year to year in Hanumangarh district along the IGNP main canal water logged area are developed around Bashir, Saharmi, Tibi, Silwala, Masitawali , Dabli Khurd, Dalan, Ranjeetpura, Meharwala, Sukh chainpura, Mohan Mangria, Lakhuwali, Naiyawali Dhani, Khete Ki Dhani, etc. Along the Ghaggar diversion canal water logged areas are salemgarh, Mainawali, Dhani Karela, Bharmsari, Khedasari.

The second worst affected area due to water logging is developed like a river channel right from Saramsar and Manaktheri in the west to Ghandheli near Manaktheri and Badopal the width of water logged area is 3 to 4 Km from here. It is important to analyze some of the important determining factors to understand the nature and extent of the problem in the study area. So I am selected these areas of research.



WATER LOGGING AREA IN HANUMANGARH DISTRICT

- RAWTSAR-Rawatsar is a city, a municipality and one of the seven tehsil in Hanumangarh District in the Indian state of Rajasthan. Rawatsar is located at 29°28'N74°38'E. some villages of rawatsar affected by water logged area Gandheli jiwannagar jakhrawali etc
- BADOPAL- Badopal mainly is a village in Pilibanga tehsil of Hanumangarh district in the Indian state of Rajasthan. Badopal is located at 29°21'30" N 74°4'49"E. Badopal is famous for salt water Lake There are variety of birds species that are found in the Badopal Lake. Around 81 species of birds have been recorded here as of 2002. Flamingo is most well known migratory birds are come in winter season.
- Tibbi (Luna Ki Dhani)- Tibbi is one of the seven tehsil headquarter of Hanumangarh district of Rajasthan state in india. It is a junction of Haryana and Rajasthan State. It is also called the "Rice Belt Of Rajasthan" Indira Gandhi Canal enter Rajasthan form Haryana, at Masitawali Head village of Tibbi. Many villages of Tibbi also affected by water logged area .I am taken Luna Ki dani of Tibbi for my research work. Which are located near Masita wali Head in Tibbi



Formation of soil salinity and degradation of plants in waterlogged area in Luna- ki-Dhani

- **METHOD OF COLLECTION-** The Water logged area was arbitrarily divided into three zones namely Rawatsar, Tibbi (Luna ki dani), Badopal in Hanumangarh District for collection of samples. The surface water samples were collected from the three different sampling sites of each zone of the Hanumangarh District for a period of one years (2019-2020), covering three seasons summer, Rainy and Winter of a year. The samples were collected in the morning hours (8:00AM-10:00AM) for the analysis o f various types of physico-chemical parameters of water. Some parameters such as temperature, pH, and Dissolved oxygen Were analyzed at showing sampling sites. Collection spot while for the analysis of other parameters the samples were carefully brought to the laboratory to carry out further study.
- **WATER TEMPERATURE-** For determination of water temperature, water samples were collected in a plastic container and soon after collection of samples, inserted a mercury thermometer which is accurate up to 0.1°C. The mercury level was noted. While taking the reading the thermometer was calibrated with another thermometer of known accuracy. Similar process was applied to determine the water temperature for each zone.
- **MIGRATORY BIRDS ANALYSIS-** Bird migration is the seasonal movement, often north and south along a flyway between breeding and wintering ground. I observed migratory birds in my research area like Rawatsar, Badopal, Tibbi and Rang Mahal. According to the Significant value of these area I observed migratory Birds by direct visual process, by photography by biconfocal camera, by nesting pattern
- **SALINITY-** There is very little variation in the salinity of coastal water. But in estuaries, the salinity varies considerably both vertically and horizontally. The salinity of fresh water is very low. The salinity of water plays a very significant role from biological point of view. The most accurate method of finding out salinity is by titration.

EFFECTS OF SEEPAGE AND WETLAND

- **DECLINE IN PRODUCTIVITY** – The productivity of the waterlogged lands specially crop yields declines substantially when the water table rise up to 1.5 m. It obviously results in drop of income by agriculture. The returns are even lesser than the cost put in by the farmers. To maintain production levels, farmers try to put in more cost but the returns keep declining. Finally, they opt rice production in the Kharif and continue with wheat or gram in the Rabi. Rice requires more water and the Rabi crops are dependent upon a minimum layer of only 0.20 m of unsaturated soil,. Therefore, salinity level increase and eventually yields of both Kharif and Rabi witness further decrease.
- **SHIFT OF EMPLOYMENT** – Loss of crop productivity has lead the farmers to quit their occupation in agriculture. There has been seen a shift to other occupations like animal husbandry and agriculture labouring. Small landholders find it difficult to keep ownerships of their land and because agriculture is the only field of their specialization, however they are forced to work under humiliation and exploitation as waged farm labours.
- **IMPACTS ON HEALTH** – The Department of Health does not treat the health impacts of waterlogging. Neither IGNP have any Health Impacts Monitoring Unit nor Command Area Development (CAD) and the Health Department. Farmers are totally unaware of the health problems of their actions and the particular implications threatened by some specific problem like surface ponding. It is indicated by some agencies that ‘‘the irrigated areas of IGNP offer good environments for the wider distribution of the malaria vectors.
- **LEVELS RISE IN GROUNDWATER** – Because of typical sub-surface composition and high percolation rates of the soils, there have been accumulation of infiltrated water in the IGNP area. Absence of proper natural drainage, presence of hydrological barrier, low permeability layer at shallow depth and seepage losses have risen the water table alarmingly in the Stage-I area where many places are acutely affected.

- **REGIONAL SALT BALANCE** – Originally, the water of the Indus River System was of good quality but it has been salinized up to high degree. Salinization is a problem specific to the water table rise areas where groundwater accumulates on surface and arises the possibility of salt deposition. These deposition in longer course can affect the crop productivity of the soil significantly.
- **DRAINAGE PROBLEMS** – Various studies in the IGNP Stage-I area indicate that potential or actual drainage conditions in the IGNP Project are related to two groups of factors : firstly, the way the irrigation system is operated at both canal and field levels, and secondly, the natural features in the soil and underlying layers down to atleast 50 m. Some waterlogging in Stage-I is a result of circumstances such as the greater availability of water and the special case of the Ghaggar Depressions.

CAUSES OF SEEPAGE

- **SEEPAGE FROM MAIN CANAL AND BRANCHES** – WTC prescribed the norm for seepage estimation in case of lined canal is $0.30 \text{ m}^3/\text{sec}/\text{Mm}^2$ of wetted perimeter and $21.45 \text{ m}^3/\text{sec}/\text{Mm}^2$ of wetted perimeter in the case of unlined canal. Main canal and branches are fully lined.
- **SEEPAGE FROM IRRIGATED AREA AND PADDY FIELDS** – Water supply and water demand data of IGNP command area suggest that there is a marked difference between the actual field requirement and the water supplies. Excess supply of water resulted seepage problem from irrigated area. Paddy crop is grown in 1.33% of the culturable command area. Groundwater Board indicates that seepage through paddy crops ranges from 0.01 MCM to 12 MCM.
- **SEEPAGE FROM GHAGGAR DEPRESSIONS** – Water flow in Ghaggar River is available only in monsoon season but it is retained in the depressions between Suratgarh town and IGNP canals. There are 18 such depressions and they have a capacity to store 840 MCM of water collectively. A diversion canal 48.17 m long (Discharge Capacity: $240 \text{ m}^3/\text{sec}$) has been constructed to direct the waters of the river to these depressions. Permanently impounded water has a high rate of infiltration, therefore, a big area in lower reaches has got waterlogging problem.
- **GROUNDWATER RECHARGE FROM DIFFERENT SOURCES** - The gross amount of the groundwater recharge in the IGNP area has been computed at 962 MCM of different sources shows a distribution of groundwater recharge.
- **ABSENCE OF NATURAL DRAINAGE SYSTEM** – One of the most important factor that causes waterlogging in the IGNP area is an absence of any natural drainage system. There is virtually no effective river in the area hence no surface drainage is possible. The river Ghaggar During its spring time in monsoon it however, inundates a 3 km wide strip in Hanumangrh district. In the study area around Rawatsar is a complete absence of any natural drainage system in this area.
- **PRESENCE OF HARD PAN** – Presently, the aquifer system in the IGNP Stage-I area is made up of a complex arrangement of layers of sand and clays. It has frequent lenses of silt, clay and kankar and occasional gravel horizons. The Quaternary ones are consist of recent and sub-recent aeolian sand deposits and alluvium. There are brownish and yellow sands, gravel and partly consolidated kankar. Presence of a hard pan is a hydrological barrier that does not allow the percolated water to infiltrate deeper. The hard pan is not continuous on a regional basis and hence it becomes difficult to design any uniform and broadly applicable remedial device. A block diagram of Masitawali Head, Rawatsar and Jhakhranwali manifests the layer wise arrangement with sand as upper most layer followed by clay and kankar immediately
- **SOIL RELATED CAUSES** - Soils of the arid region are generally sandy and considered infertile. The soils of the IGNP area form a part of vast former flood-plains mixed with sandy aeolian deposits of Ghaggar, Saraswati, Chautang, Sutlej and Eastern branches of Indus. All of them eventually drained at some period in the past into the Rann of Kachchh. During the Pleistocene time, the western Rajasthan became gradually drier. Two dominant soil formations present in the area are flood-plains and aeolian deposits. At some places, desert plain soils and lateritic crusts are also found..
- **HIGH WATER ALLOWANCE** – Excess application of water particularly during the initial years when the command area was not fully developed and constant excessive intense irrigation are two of the important causes of waterlogging.

- **POOR ON FARM MANAGEMENT AND UNREALISTIC CROPPING PATTERNS** – The entire Rajasthan state in general and the area covered by IGNP in particular has very poor rural literacy rates. This poor literacy results in farmers inability to understand the problem in proper aspect. They have less knowledge of pesticides and banned chemicals. In case of waterlogged areas, farmers have shown particular ignorance in selection of crops. They have constantly tried to yield crops with higher water demands.
- **RAINFALL AND AVAILABILITY OF WATER** – Rainfall and availability of water in the canal system are two significant factors that affect the degree of waterlogging on a land. Decline in water table and the status of waterlogging in the IGNP area in general and the study area in particular are result of scanty rainfall and poor availability of water in the canal system.

REMEDIAL MEASURES

In devising anti-water logging measures, the nature and magnitude of various factors, enumerated in previous article, should be correctly assessed and allowed for various remedial measures adopted for prevention of water logging.

- **EFFICIENT SURFACE DRAINAGE**-This system, which permits a quick flow of rainwater in short period, helps to reduce the water logging. They have initial cost of construction.
- **UNDER DRAINAGE BY TILE DRAINS**- The drainage of agricultural land is done more satisfactorily by the drains. A suitable tile drain can hold the water table at a predetermined level which will be most beneficial to the crops. It has large initial cost.
- **RESTRICTION OF IRRIGATION**-
 - (a) The cultivators should be educated for economic use of water and induced to divided his field into “Kiaris” to avoid wastage. He should also encouraged supplementing his water requirement from open and tube wells.
 - (b) Area with high water table may be allowed only for Kharif irrigation and during Rabi the cultivators may irrigate from open and tube wells.
- **LINING OF WATER COURSES**- The losses by percolation from cultivators water course are the order of 20% and above. Their lining therefore, further checks the inflow of canal water to subsoil through water courses.
- **REMOVING OBSTRUCTION IN NATURAL DRAINAGE**- Drainage crossing with road, railways and canals should be remodeled to make it more efficient.
- **PREVENTION OF SEEPAGE FROM WATER RESERVOIR**- Adequate and suitably designed to filters provided so that seepage ultimately finds its way into the natural stream.
- **ADOPTION OF SPRINKLER METHOD FOR IRRIGATION**- This reduces the percolation losses from watercourses as only predetermined amount of water is applied to the land.
- **CHANGES IN CROP PATTERN**- A change in crop pattern may minimize the damage to plant line.

CONCLUSION

1. Agricultural potential in Rawatsar block is high with respect to ground water quality. Water having EC < 4000 mmhos occurs in major part of the district which can be used for growing semi tolerant to salt tolerant crops.
2. In some areas, fresh water cushions have been developed due to seepage of canal water accumulated over impervious formation. Therefore attempt has to be made to locate those points where maximum thickness can be ascertained and ground water can be exploited judiciously.
3. Anti water logging measures should be taken to avoid further water logging in the areas around natural depressions.
4. It is strongly advocated that a massive ground water development programme may be launched especially in the Ghaggar flood plain area where the quality of ground water is suitable for irrigation
5. Saline ground water available in the district can be used for agriculture by blending with canal water or using in lean period. Batteries of tubewells tapping saline water can be constructed along Pilibanga branch for use in conjunction with fresh canal water.
6. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this.
7. High water requirement crops need to be discouraged. Proper agriculture extension services should be

provided to the farmers so that they can go for alternate low water requirement economical crops.

8. Implementation of further ground water development programme in the area must be under competent technical supervision to avoid well failures and saline water ingress.

9. Sewage reclamation should be an important part of the development of irrigation sector. It is required to avoid contamination of water resources. This source of irrigation water is highly reliable, albeit only for non-edible crops.

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